Engineering

SYNTHESIS OF A METAL-CERAMIC GRADIENT TETRALATTICE SAMPLE

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Abstract

Solid freeform fabrication (SFF) allows production of new composite materials, known as functional gradient materials (FGMs), in complex geometries that were once unachievable using conventional methods of manufacturing. FGMs, advanced with Gradient TetraLattice (GTL), provide the ability to transform internally from 100% of one material on one end to 100% of another material on the other end in a strict geometric fashion. The new material will have the combined properties of the two materials used to create it. Two TetraLattice (TL) shapes, one made of metal and the other of ceramic, are intertwined to form one GTL. One potential application for a GTL material would be on the space shuttle. Currently there is no single material capable of meeting all of the thermal protection system (TPS) requirements on the shuttle. Some of the TPS requirements include having a long fatigue life, withstanding rapid temperature changes, and adhering to the aluminum alloy airframe. The aerospace industry can benefit from these lightweight FGMs, which are easier to produce, require less material, and are less expensive than current products and methods. The goal of this research project is to produce the first Metal-Ceramic Gradient TetraLattice sample.